REMARKS

Claims 1-15, 20 and 21 were objected to because of informalities. These informalities have been corrected. No new matter was added.

Claims 1, 7-15, 20 and 21 are rejected under 35 U.S.C. 102(e) as being anticipated by Chennakeshu et al. Claims 1, 3, 4 and 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Chennakeshu et al. Claim 16 was rejected under 35 U.S.C. 103(a) as being unpatentable over Strolle et al. and Chennakeshu.. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Strolle et al. in view of Ghosh. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Strolle et al. in view of Ghosh as applied to claim 17 above, and further in view of White et al. Claim 19 was rejected under 35 U.S.C. 103(a) as being unpatentable over Strolle et al. in view of Ghosh as applied to claim 17 above, and further in view of Chennakeshu et al. Claim 2 was rejected under 35 U.S.C. 103(a) as being unpatentable over Chennakeshu et al. in view of White. Claim 5 was rejected under 35 U.S.C. 103(a) as being unpatentable over Strolle et al. in view of White et al. Claim 6 and 22 were rejected under 35 U.S.C. 103(a) as being unpatentable over Strolle et al.

Independent claims 1, 16, 17, and 20 have been amended to clarify the language of these claims. Claim 1 recites, inter alia, "a second filter connected to the first filter and operable for reducing the amount of noise and inter symbol interference in the demodulated complex valued digital signal without the use of training data . . . ." Claim 16 recites, inter alia, a rotator having an adaptive input and connected to receive the pre-equalized complex-valued signal and operable for restoring the phase of input data contained in the pre-equalized complex-valued signal without the use of training data; a feed forward equalizer finite input response filter having an adaptive input, an input connected to the rotator, an output, and operable for adaptively reducing the amount of noise and inter-symbol interference in the pre-equalized complex-valued signal without

the use of training data . . . ." Claim 17 recites, inter alia, "adaptively equalizing the pre-equalized complex-valued signal to reduce the inter-symbol interference and to produce a corrected complex valued symbol signal without the use of training data . . . ." Claim 20 recites, inter alia, "a second filter connected to the first filter and operable for reducing the amount of noise and inter symbol interference in the demodulated complex valued digital signal without the use of training data . . . ."

The cited references lack the above quoted elements of the claimed invention. The Office Action relies on Chennakeshu et al for the 35 U.S.C. 102(e) rejections and various of the 35 U.S.C. 103(a) rejections. However, Chennakeshu et al, does not disclose or suggest, inter alia, the above quoted elements. Chennakeshu et al actually teaches away from the present invention in that it uses a training mode to compensate for ISI. (Col. 6, lines 32-47). The Office Action cites Strolle as disclosing "that the system uses blind equalization (i.e. without training data) in column 3, line 6 . . . ." (Office Action, paragraph 14). Strolle simply states that "equalizer 14 is initialized using blind equalization or using training signal techniques." Strolle does not disclose or suggest any way or even the need to improve blind equalization.

In fact, Applicants acknowledge the existence of blind start-ups in the BACKGROUND OF THE INVENTION and further identify that "there is a need in the art to provide a solution for the blind start-up process of a receiver in the context of digital communications signals in the presence of severe ISI and severe narrow-band interference." None of the cited references recognize the problem let alone provide a solution as provided in the present invention.

Claims 2, 5, 6, 16-19 and 22 were rejected under 35 U.S.C. 103(a) in view of combinations of numerous references. Regarding these obviousness rejections, Applicants respectfully submit that the rejection of should also be withdrawn for the above stated reasons.

Moreover, in addressing obviousness rejections, the Patent and Trademark Office Board of Patent Appeals and Interferences, in Ex parte Clapp, 227 USPQ 972 (1985), stated: "Presuming arguendo that the references show the elements or concepts urged by the examiner, the examiner has presented no line of reasoning, and we know of none, as to why the artisan viewing only the collective teachings of the references would have found it obvious to selectively pick and choose various elements and/or concepts from the several references relied on to arrive at the claimed invention. In the instant application, the examiner has done little more than cite references to show that one of more elements or subcombinations thereof, when each is viewed in a vacuum is known. The claimed invention, however, is clearly directed to a combination of elements. That is to say, appellant does not claim that he has invented one or more new elements but has presented claims to a new combination of elements. To support the conclusion that the claimed combination is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed combination or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. We find nothing in the references that would expressly or impliedly teach or suggest the modifications urged by the examiner. Additionally, as aforementioned, we find no line of reasoning in the answer, and we know of none, as to why the artisan would have found the modifications urged by the examiner to have been obvious. Based upon the record before us, we are convinced that the artisan would not have found it obvious to selectively pick and choose elements or concepts from the various references so as to arrive at the claimed invention without using the claims as a guide."

The Patent and Trademark Office Board of Patent Appeals and Interferences further stated in Ex parte Nesbit, 25 U.S.P.Q.2d (BNA) 1817 (1992) that: "In establishing a prima facie case of obviousness under 35 USC 103, it is incumbent upon the examiner to provide a reason why one of ordinary skill in the art would have been led to modify a prior art reference or to combine reference teachings to arrive at the claimed invention. Ex parte Clapp , 227 USPQ 972 (BPAI 1985). To this end, the requisite motivation must

stem from some teaching, suggestion or inference in the prior art as a whole or from the knowledge generally available to one of ordinary skill in the art and not from appellants' disclosure. See, for example, Uniroyal Inc. v. Rudkin-Wiley Corp , 837 F.2d 1044, 5 USPQ2d 1434 (Fed. Cir. 1988)." For the reasons recited in the above quoted cases, Applicant respectfully submits that the rejected claims are not obvious in view of the cited reverences.

Applicant respectfully submits that it would not have been obvious to a person of ordinary skill in the art to combine the numerous cited references, even if combinable in the manner suggested by the Office Action, to make the claims of the present invention obvious.

Applicants respectfully submit that, as amended, the claims are fully supported by the drawings and specification. Clarifications have been added facilitate understanding of the various elements of the claims.

In view of the above, Applicants respectfully submit that the claims of the present invention are patentable request that the 35 U.S.C. 102, and the 35 U.S.C. 103, rejections of claims 1-22 be withdrawn.

The amendments and remarks herein are believed to be fully responsive to the Office Action dated May 23, 2002 and to place this application in condition for allowance. In light of the above, reconsideration and allowance of claims 1-22 is respectfully requested. A one month Extension of Time is included herewith.

The U.S. Patent and Trademark Office is authorized to charge any fee deficiency or credit any overpayment to deposit account 20-0668 of Texas Instruments Incorporated.

If the Examiner has any questions or other correspondence regarding this application, Applicants request that the Examiner contact Applicants' attorney at the below listed telephone number and address.

Respectfully submitted,

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Serial No. 09/230,069
TI-30340

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Replace the paragraph beginning on page 5, line 30 and ending on page 6, line 13, with the following:

Figure 5 illustrates the DFE (Decision Feedback Equalizer). The DFE's input sequence $s_2[n]$ is first rotated by an adaptive rotator 501, by an angle $\theta[n]$. The rotated sequence is then filtered by an FFE (Feed Forward Equalizer) FIR filter 502 whose taps' values are $c_n[1]..c_n[M]$ (M □ 1), to produce output signal [s_3]$\underline{s_4}[n]$. Signal "[s_3]$\underline{s_4}[n]$ is then summed 507 with the output of an adaptive FIR filter 504 whose taps are $d_n[1]..d_n[N]$, N □ 0, and which is driven by the sequence of detected symbols â[n]. The result of this summation is equalized sequence $s_5[n]$, 506. The sequence 506 is fed to a symbol detector 503 that employs a memoryless nearest neighbor decision rule, based on the transmitted symbols' I-Q constellation to generate the sequence â[n]. We note that in this preferred embodiment, a single memoryless decision rule is employed. However, the present invention can be employed in a receiver that employs a more accurate detection scheme such as an approximate nearest sequence detector which is the maximum likelihood sequence estimator when the noise of the input of unit 503 has a Gaussian distribution.

IN THE CLAIMS:

1. (amended) A communication receiver, comprising:

an input receiving a modulated analog signal containing digital information;

a front end unit operable for performing analog to digital conversion, for performing demodulation and for performing timing control, and further operable for producing a demodulated complex-valued digital signal from the modulated analog signal;

a digital equalizer connected for receiving the demodulated complex valued digital signal, comprising:

a first filter operable <u>for</u> receiving the demodulated complex valued digital signal;

a second filter connected to the first filter and operable for reducing the amount of noise and inter symbol interference in the demodulated complex valued digital signal <u>without the use of training data</u>; and

a symbol-to bit converter connected to the second filter.

16. (amended) A digital communication receiver, comprising:

a input stage receiving an analog signal containing digital information;

an analog to digital converter connected for producing a complex-valued digital signal from the modulated analog signal;

a demodulator connected for producing a demodulated complex-valued digital signal from the complex-valued digital signal;

a pre-equalizer filter connected to receive the demodulated complex-valued digital signal, comprising:

a first adaptive finite response filter having an output, having a tap adjustment input and connected to receive the demodulated complex-valued digital signal;

a first summation circuit connected to sum the demodulated complex-valued digital signal with the output of the first adaptive finite response filter to produce a pre-equalized complex-valued signal;

a function circuit connected to receive the pre-equalized complex-valued signal and operable for producing there from a non-linear response to the pre-equalized complex-valued signal;

an adaptation unit connected to receive the demodulated complex-valued digital signal, connected for receiving the non-linear response and connected to the tap adjustment input of the adaptive finite response filter to provide an adjustment to the first adaptive finite response filter;

a digital decision feedback equalizer connected to receive the pre-equalized complex-valued signal, comprising:

a rotator having an adaptive input and connected to receive the pre-equalized complex-valued signal and operable for restoring the phase of input data contained in the pre-equalized complex-valued signal without the use of training data;

a feed forward equalizer finite input response filter having an adaptive input, an input connected to the rotator, an output, and operable for adaptively reducing the amount of noise and inter-symbol interference in the pre-equalized complex-valued signal <u>without the use of training data</u>;

a second summation circuit connected to sum the output of the feed forward equalizer finite input response filter with the output of a second adaptive finite response filter and for producing therefrom a corrected complex-valued signal;

a symbol detector connected to receive the corrected complex valued signal and to produce a symbol signal;

the second adaptive finite response filter having an output, an adaptive input and connected to receive the symbol signal;

wherein the corrected complex-valued signal is connected to the adaptive input of the rotator, the adaptive input of the feed forward equalizer finite input response filter and the adaptive input of the second adaptive finite response filter; and

a symbol-to-bit converter connected to receive the symbol signal and to produce therefrom digital bits corresponding to the digital information.

17. (amended) A method of receiving a digital communication signal in the presence of inter-symbol interference, comprising the steps of:

receiving an analog signal modulated with digital information;

converting the analog signal to produce a digital signal;

multiplying the digital signal with sine and cosine signals to produce a complex-valued digital signal;

adaptively pre-equalizing the complex-valued digital signal to produce a pre-equalized complex-valued digital signal;

adaptively equalizing the pre-equalized complex-valued signal to reduce the inter-symbol interference and to produce a corrected complex valued symbol signal <u>without the use of training data</u>; and

converting the corrected complex valued symbol signal to the digital information.

20. (amended) A communication system, comprising:

a digital communications transmitter;

a communications medium; and

a digital communications receiver, comprising:

a input receiving a modulated analog signal containing digital information;

an analog to digital converter connected for producing a complex-valued digital signal from the modulated analog signal;

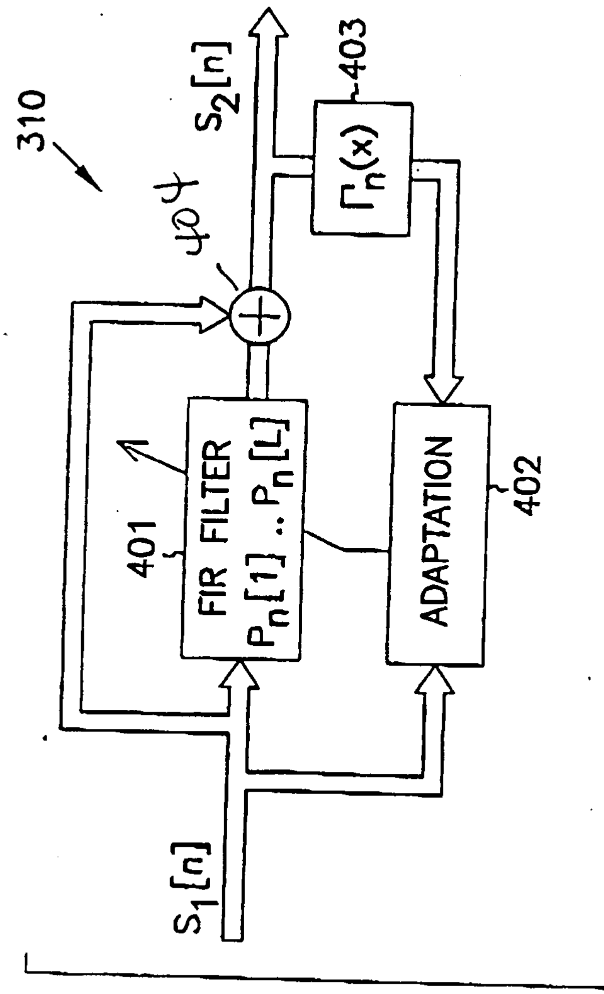
a demodulator connected for producing a demodulated complex valued digital signal from the complex valued digital signal;

a digital equalizer connected for receiving the demodulated complex valued digital signal, comprising:

a first filter operable for receiving the demodulated complex valued digital signal;

a second filter connected to the first filter and operable for reducing the amount of noise and inter symbol interference in the demodulated complex valued digital signal without the use of training data; and

a symbol-to bit converter connected to the second filter.



$$S_2[n] = S_1[n] + \sum_{\ell=1}^{L} P_n[\ell] S_1[n-\ell] \qquad (\ell \geq 0)$$

$$P_{n+1}[\ell] = P_n[\ell] + \Gamma_n(S_2[n]) \cdot S_1^*[n-\ell] \qquad (\ell = 1..L)$$

$$\Gamma_n(x) = \delta_P[n] \cdot x$$

FIG. 4